

Seed Dormancy

Definition

Non-germination of seeds due to absence of suitable conditions is termed as dormancy.

OR, A physical or physiological condition of viable seed, which prevents germination even in the presence of favorable conditions.

The main factors that causes the seed dormancy

1. **Seed coats impermeable to water:** The seed of certain family have very hard seed coats which are impermeable to water. This dormancy remains until the testa layer decay by soil microorganisms. The impermeable seed coats are found in the family leguminosae, Malvaceae, convolvulaceae.
2. **Seed coat impermeable to oxygen:** This type of dormancy is because of the impermeability of the seed coats to oxygen. But later seeds become more permeable to oxygen so that it germinates afterwards. This type of dormancy is found in the family compositae.
3. **Mechanically resistant seed coat:** In some seeds as those of mustard (Brassica), pigweed (Amaranthus), shepherd's purse (Capsella) etc. the seed-coats are so strong that they do not yield to the pressure of the expanding embryo. The embryos of these seeds have no dormant period and will grow readily if the seed coats are removed.
4. **Immaturity of the embryo:** In the seeds of plants, like the Orchids, Ginkgo etc. the immaturity of the embryo is due to the failure of the embryo to develop when the seeds are shed.
5. **Due to the effect of germination inhibitors:** The inhibition caused due to the presence of the inhibitor substances in the seed coat, endosperm, embryo or any structure. Some of the important germination inhibitors are; Coumarin, Phythalids, Ferulic acid, Absciscic acid, Dehydracetic acid and parasorbic acid.
6. **Low temperature:** In certain plants, the seeds remain dormant after harvest because they require low temperature for germination. The seeds germinate in the spring season.
7. **Light sensitive seeds:** In certain seed, the germination is affected by the light so the absence of light results in the seed dormancy. These seeds which are sensitive to sunlight are termed as the photoblastic seeds, where as in some other seeds the light inhibits the seed germination so they are negatively photoblastic.

8. **Rudimentary Embryos:** In plants like ginkgo (*Ginkgo biloba*), European ash (*Fraxinus*), holly (*Ilex*) and many orchids, the embryo is unorganized when the seed is shed and attains full development before it germinates.
9. **Dormant Embryos:** In many species, although the embryos are completely developed when the seed is ripe, the seed fails to germinate even when environmental conditions are favourable. Dormancy of such seed is a result of the physiological condition of the embryo. The embryos of such seeds will not grow when the seeds first ripen even if the seed coats are removed. During the period of dormancy, some physiological changes called after-ripening occur in the embryo before the seed is capable of germination. The seeds of apple, peach, iris and pine belong to this group. In nature, after-ripening occurs in winter and the seeds formed in autumn germinate the coming spring.

Advantages/Importance of Seed Dormancy

- Plant embryo survives during adverse conditions of weather, which are not favorable for growth (like winter).
- Creation of a seed bank.
- Seed dormancy allows more time for widespread seed dispersal.
- In some cases of dormancy one year's seeds do not germinate the same year, this improves species survival.
- It prevents the germination of seed in the field during production.
- Dormancy helps in the storage of seed in the store house.
- It contribute the longevity of the species.
- It helps in the transformation of seeds from one place to another place.
- Due to dormancy, we can use the crop as a food material.

Disadvantages

- ◆ It extends the time necessary for germination.
- ◆ It interfere with the planting schedule.
- ◆ It creates unnecessary troubles in testing seeds.

Types of Dormancy

The seed dormancy is divided into following groups-

1. Exogenous

Exogenous dormancy is caused by conditions outside the embryo and is often broken down into three subgroups.

- **Physical dormancy:** Dormancy that is caused by an impermeable seed coat is known as physical dormancy.
- **Mechanical dormancy:** Mechanical dormancy occurs when seed coats or other coverings are too hard to allow the embryo to expand during germination.
- **Chemical dormancy:** Includes growth regulators etc. that are present in the coverings around the embryo. They may be leached out of the tissues by washing or soaking the seed, or deactivated by other means.

2. Endogenous

Endogenous dormancy is caused by conditions within the embryo itself and it is also often broken down into three subgroups: physiological dormancy, morphological dormancy and combined dormancy.

- **Physiological dormancy:** Physiological dormancy prevents embryo growth and seed germination until chemical changes occur. Physiological dormancy is indicated when an increase in germination rate occurs after an application of gibberellic acid (GA3).
- **Morphological dormancy:** In morphological dormancy, the embryo is underdeveloped or undifferentiated.
- **Combined dormancy:** Seeds have both morphological and physiological dormancy.

3. Combinational dormancy

- Combinational dormancy occurs in some seeds, where dormancy is caused by both exogenous (physical) and endogenous (physiological) conditions.

4. Secondary dormancy

- Secondary dormancy occurs in some non-dormant and post dormant seeds that are exposed to conditions that are not favorable for germination, like high temperatures. It is caused by conditions that occur after the seed has been dispersed. The mechanisms of secondary dormancy are not yet fully understood but might involve the loss of sensitivity in receptors in the plasma membrane.

Methods of Breaking Seed Dormancy

► Stratification

Some seeds contain germination inhibitors that break down when exposed to cold temperatures. This is nature's way of preventing the seed from germinating before spring arrives. Stratification exposes the seeds to cold temperatures in the refrigerator, simulating a short winter. When brought back to room temperature, they germinate readily. Large seeds are easy to stratify by placing them between moist paper towels or in a jar of moist sand in the refrigerator. It's best to plant small seeds in a tray of soil before refrigerating them. It takes between two and six weeks of cold temperatures to break down the inhibitors, depending on the type of seed.

► Scarification

Any treatment i.e. physical or chemical that weakens the seed coat, is known as scarification. Scarification method is applied, when dormancy is imposed by hard seed coat. e.g. in legumes- *cajanus cajan*, gram etc.

In this method there are various ways to break hard seed coat such as:

1. Seeds are either rubbed on a sand paper manually. At the time of rubbing care should be taken that not to damage the axis of the seed e.g. Green gram.
2. When seed coat is too hard i.e. of woody nature, the seed coat has to be removed completely by breaking it. E.g. Rubber (*Havea* spp) seed, India teak wood seed.

► Soaking treatment

Soaking hard seed coat in concentrated or diluted solution of sulphuric acid for 1 to 60 minutes, it removes seed coat impermeability. E.g. cotton seeds, India teak wood seeds etc.

► Temperature Treatments

1. When the dormancy is due to embryo factor i.e. the seed is incubating at low temperature (0-5°C) over a substratum for 3-10 days placing it at optimum temperature required for germination. E.g. mustard (*Brassica campestris*).
2. Some seeds require a brief period of incubation (from a few hours to 1-5 days) at 40-50°C before germinating at required temperature. In this method, care should be taken that moisture content of the seed is not more than 15% e.g. paddy (*Oryza Sativa*).

► Hot Water treatment

Hot water treatment is also an effective method of breaking hard-seedness in legumes. In this method, the seeds are soaked in water at 80°C temperature for 1-5 minutes (depending up on the type of seed) before putting for germination.

► Light Treatments

Some seeds do not germinate in dark thus it provides continuous or periodic exposure of light is essential. e.g. Lettuce (*Lactuca Sativa*) required red light (660 nm) or white light is essential for germination to occur.

► Use of growth promoting substances

Certain chemicals promote the seed growth. Potassium nitrate, thio-urea and ethylene ehlorhydrin are the most commonly used germination promoters. Similarly, the application of some of the plant hormones like gibberellic acid, cytokinin and ethylene also promotes.

► By pressure

It is used to break down the seed dormancy in those seed which seed coat are very strong and shell like. In this method, pressure is applied to rupture seed coat that gaseous exchange and water intake may take place.

► By supplying oxygen

The supply of oxygen is an important factor for germination. It has been found that the percentage of germination can be increased when the supply of oxygen is reduced.